

Robotic surgery beyond the prostate

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Although robotic urological surgery has come a long way in the United States over the last 15 years, globally, it is still in its infancy. Even in the United States, while the vast majority of radical prostatectomies are now performed robotically, the same cannot be said about many other common urological procedures. There was a time when robotic prostatectomy was viewed with skepticism; now nearly 90% of all radical prostatectomies in the United States are performed robotically. Partial nephrectomy is now the fastest growing robotic urological procedure; however, less than 40% of all partial nephrectomies in the US are performed robotically. Nevertheless, the advent of robotics has contributed to the increased dissemination of partial nephrectomies for the management of renal masses, and more patients are getting partial nephrectomy rather than radical nephrectomy for small renal tumors compared with a decade ago. Robotics is also making inroads into the last bastions of open oncology—namely, IVC thrombectomies and radical cystectomies with intracorporeal diversions. Select surgeons are also performing robotic kidney transplantations and retroperitoneal lymph node dissections robotically, and these advanced indications are likely to see increased growth over the next 5 years.

However, much work lies ahead. The lack of demonstrable superiority over conventional open surgery has prompted critics to question the rationale for robotic surgery itself, given its higher initial capital outlay and high recurring costs of an annual maintenance contract and disposables. Naysayers suggest that with the passage of the Affordable Care Act in the US and the impending cost-reduction strategies, it is just a matter of time that medical institutions will move away from expensive robotic surgery to less-expensive conventional laparoscopic or

open surgery. This, to my mind, is a rather simplistic way of looking at things.

It is true that comparative effectiveness studies have not provided level I evidence supporting superior outcomes with robotic surgery. The most common robotic procedure in urology is robotic prostatectomy; this has never been compared with a conventional retropubic radical prostatectomy in a large robust prospective randomized trial. It is unlikely that it ever will be. It will now be very difficult to accrue patients, or surgeons, for a large, well-designed meaningful trial. Most surgeons who have switched to performing this operation robotically and have spent time to master the technique are unlikely to go back to performing this laparoscopically or open surgically. Most trainees who graduate from a residency or fellowship programs in the US, in the near future, will have performed more robotic procedures than open procedures. Slowly but surely, robotic prostatectomy has become the standard of care, at least in the United States. The open surgical skill-set has been eroded just as it has been for other procedures like open surgery for urolithiasis and open cholecystectomy. If we now stop robotic surgeries and force surgeons and new trainees to go back to performing open procedures, surely the outcomes will be disastrous.

This symposium of the Indian Journal of Urology focuses on robotic urology beyond the prostate. The Journal has assembled a stellar group of authors who cover almost the entire gamut of non-prostate robotic urology. All these procedures are increasingly being adopted in the West. At our institution, nearly 95% of all prostate and kidney cancer surgeries are performed robotically, and almost 40% of all radical cystectomies are robotic. There has been a steady uptick in the number of robotic system installations in Asia and South America as well. The groundswell is unmistakable.

A real problem, especially for developing countries, is the high cost of procuring and running a robotic system. The main reason for this high cost is the monopoly that the manufacturer of the only Food and Drug Administration (FDA)-approved robotic surgical system enjoys in this space. Most of us recall how the cost of

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shock wave lithotripters went down rapidly once competing manufacturers entered this arena. Competition is necessary not only to drive the cost down but also to provide a superior product to the surgeon and the patient. Progress in medical robotic technology has been painfully slow. Technologies exist on earth to land a rover remotely in a field on Mars,^[1] yet we struggle to make substantial progress in medical robotics.

Disruptive technologies are a must if this field has to move forward. We are at the very beginning of what portends to be a revolution in how medical and surgical care will be delivered going forward. Smaller, better and cheaper robots are needed in the medical arena. Simulation in medical training is in its infancy. There is no reason why a trainee should not spend several hours gainfully practicing various permutations and combinations of a specific type of surgery on an inanimate simulator before actually operating on a patient under supervision.^[2] If this is required of airline pilots because lives depend on them, it should be required of medical personnel too! High-quality simulators are essential for safe and widespread adoption of advanced robotic techniques. Technologies exist in other disciplines; they just need to be channeled into medical applications.

Increasingly, the world is becoming a place where borders are becoming less conspicuous. Then why is it that an expert surgeon sitting in Mumbai cannot help a colleague in Jakarta with a difficult case in real time? Global tele-mentoring and tele-surgery can be a reality with robotic platforms. These are again very important for rapid and safe dissemination of advanced techniques.

Autonomous robotic systems are unlikely to be approved by the FDA anytime soon, and understandably so. There are engineering, medical, ethical and legal issues to be

considered in the development of autonomous surgical robots. While research is ongoing, technical challenges are enormous. Unlike car or aircraft manufacturing, human anatomy and disease pathology are extremely variable, and the stakes are much higher. How does one write algorithms that allow an autonomous surgical robot to clearly identify variant anatomy and then make “intelligent” decisions keeping in “mind” the pros and cons of each step? How does the robot identify problems that are out of the ordinary and take appropriate steps to “fix” them or “call for help”? Clearly, we are many years away from truly autonomous robots, although we are likely to see some basic aspects of robotic surgery to be automated in the near future. The National Science Foundation (NSF) in partnership with the NASA, NIH and USDA have awarded millions of dollars in grants to various groups to carry out research and design next-generation co-robots with the aim of working “collaboratively” with humans!

Whatever the future holds, one thing is certain-robotic surgery in urology is here to stay, and the indications and scope will continue to expand. Undoubtedly, we are at the cusp of a revolution in the field of surgical robotics.

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